

VI. "Appendix to Paper\* on Descending Degenerations following Lesions in the Gyrus marginalis and Gyrus fornicatus in Monkeys." By E. P. FRANCE. Communicated by E. A. SCHÄFER, F.R.S. Received April 22, 1889.

(Abstract.)

This appendix contains an account (1) of the degenerations which have resulted from lesions of the external motor cortex alone; (2) of the degenerations which have resulted from lesions involving both this and the gyrus marginalis; and (3) a comparison between the respective degenerations resulting from lesions of the external motor surface and of the gyrus marginalis. The results tend to show the existence of a differentiation in the pyramidal tract, the whole area of which is involved in degeneration when both external and mesial motor areas have been removed, whereas after removal of one portion only of the motor area, a corresponding part only of the pyramidal tract area degenerates.

VII. "On *Phymosoma varians*." By ARTHUR E. SHIPLEY, M.A., Fellow and Lecturer of Christ's College, Cambridge, and Demonstrator of Comparative Anatomy in the University. Communicated by A. SEDGWICK, F.R.S. Received May 1, 1889.

(Abstract.)

The following observations on *Phymosoma varians* were made on a number of specimens brought from the Bahama Islands by Mr. W. F. R. Weldon, of St. John's College, Cambridge. I am not only indebted to Mr. Weldon for the material of this article, but for very valuable suggestions and assistance while carrying on my investigations.

The *Phymosoma* is found embedded in soft coral rock. The length of the fully extended specimens averages 5 cm., the greatest diameter about 5 mm. The introvert is equal in length to the rest of the body.

*The Head.*—The head bears a crown of tentacles, which are always equal in number, usually eighteen; they are arranged in a horse-shoe shaped lophophore, which is dorsal to the mouth. The ends of this horse-shoe are confluent with those of a vascular lower lip, which is also horse-shoe shaped; the crescentiform opening between these two

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structures is the mouth. The space included in the cavity of the tentacular horse-shoe—the representative of the pre-oral lobe—is covered with a peculiar pigmented epithelium, curiously wrinkled. This epithelium is continuous with the brain, and from it two sensory pits descend into that organ. The tentacles are short, the outer surface is grooved and ciliated, the inner surface covered with a pigmented epithelium, similar in character to that covering the pre-oral lobe.

The introvert immediately behind the head is smooth for about 2 mm. At the posterior end of this region a thin but very extensible collar is attached. The anterior end of the collar is free, and in specimens with the introvert inverted, completely covers the head. Behind the collar the introvert is surrounded by rings of hooks. Each hook is secreted by a multicellular papilla, and the ring rests upon a cushion formed by circular muscle fibres. Behind each ring of hooks is a parallel ring of sense organs, described below, and underneath each ring is a circular nerve, continuous with the ventral cord.

*The Ectoderm.*—The ectoderm covering the lower lip and the outside of the tentacles is ciliated, that covering the pre-oral lobe and the inside of the tentacle is crowded with brown pigment granules. The ectoderm of the rest of the body is one cell thick. It is curiously vaulted, leaving irregularly scattered spaces between it and the outside of the circular muscles, in which a nutritive fluid probably circulates. On its outer surface the ectoderm secretes a thick cuticle. From time to time some of the ectodermal cells are modified to form the skin papillæ. These are in the form of double cups, the inner lining of which consists of very large cells crowded with yellow spherules. The cup opens to the exterior by a minute pore. These papillæ are particularly large and numerous at the extremities of the trunk and on the dorsal surface. Those of the introvert differ from those on the trunk by the possession of a chitinous ring round their orifice.

*General Anatomy.*—There is nothing peculiar in the general anatomy of this Gephyrean as seen by the naked eye. Of the four retractors, the two ventral ones are much longer than the two dorsal, and at the base of the former is the generative organ. The intestine is supported by a spindle muscle, as well as by a muscle which passes from the ventral body wall to the anterior end of the visceral loop. There are about twenty-two longitudinal muscles in the middle of the trunk. The body cavity is lined by a flat epithelium, which is never ciliated.

*The Skeletal Tissue.*—I have given this name to a peculiar form of tissue which is found in the collar and tentacular crown of *Phymosoma*. The cells composing this tissue are roundish, with large nuclei. The protoplasm of the cells is traversed by numerous fine lines, and both it and the nuclei readily take up staining fluid. The cells are not so closely packed as to lose their shape.

This tissue forms a ring in the lower lip, external to the vascular spaces in this region; it also sends extensions into the tentacles. It seems to support and stiffen these structures, and from its position serves as a firm hold for the insertion of the retractor muscles of the introvert, which are attached just behind it.

*The Alimentary Canal.*—The œsophagus is lined with ciliated epithelium, continuous with that of the lower lip and the tentacles. Its cavity is diminished by numerous ridges, the grooves between which are continuous with the grooves on the tentacles. The intestine forms about fifteen coils; it is usually full of fine sand, and appears to be partly ciliated, though there is no ciliated groove as in *Sipunculus*. The rectum is straight, and its cavity is also occluded by ridges. The anus is surrounded both by a sphincter muscle and by a number of radiating fibres.

*The Vascular System.*—There are two kinds of blood corpuscles present in *Phymosoma*. The larger kind occurs in the body cavity: they are oval in outline, with a spherical nucleus. The smaller kind is found in a closed series of spaces usually termed the vascular system. This space may be described as consisting of three parts, all communicating with one another. The first of these lies in the lower lip, and consists of a number of channels anastomosing with one another, the interspaces being occupied by the skeletal tissue described above. These channels open at their dorsal ends into the second series, which forms a space at the base of the lophophore. This gives off a number of spaces, which pass into the tentacles and open in the middle ventral line into the dorsal vessel. This is a muscular sac which is attached to the dorsal surface of the œsophagus between the retractor muscles of the right and left side. It serves as a reservoir, into which the corpusculated fluid is driven when the introvert is retracted and the tentacles are flaccid. By the contraction of its wall the blood is forced into the lower lip and lophophore, and these organs are then dilated. The whole is lined by a flat epithelium.

*The Nephridia.*—Each nephridium consists of two parts, the bladder and the true secreting part. Both these parts are well supplied with muscle fibres and are consequently very contractile, so that their shape varies greatly in different specimens. The bladder, which is the anterior half, is attached to the body wall by mesenteries, the secreting part is free. The bladder opens to the exterior by a circular mouth, and to the interior or body cavity by a ciliated opening in shape like a flattened funnel. The lumen of the secretory part is broken up into a number of side chambers, which may be readily described by comparing them to the air-chambers in the interior of a frog's lung. The whole is lined by a very peculiar epithelium. The cells composing this are columnar in shape, with their nuclei at the base. They are crowded with minute spherical granules, and many

of them have at their free end a bubble or vesicle in which these granules have accumulated. From time to time these vesicles break off and lie in the lumen both of the secretory part and of the bladder, and are no doubt extruded from the body. The whole process is very like the excretion of milk in a mammary gland. The only other structures, besides these vesicles, found in the lumen of the nephridia are the generative cells, ova and spermatozoa; it is remarkable that the cœlomic corpuscles never enter them.

*The Nervous System.*—The brain is a bilobed organ lying immediately beneath the pre-oral lobe, with the ectoderm of which it is continuous. The ventral and posterior surfaces project into a blood sinus which is situated in the neighbourhood of the junction of the lophophoral vessels with the dorsal vessel. The ganglia in the brain form a cap on the anterior, dorsal, and posterior surfaces, enclosing the fibrous tissue which comes to the surface of the brain ventrally. The ganglion cells are mostly small and bipolar, but on the posterior surface are a certain number of unipolar giant ganglion cells, with a diameter at least four times that of the smaller cells.

The brain gives off three pairs of nerves; at the side a pair of circumœsophageal commissures which pass round the œsophagus and fuse to form the ventral nerve cord. This has no trace of a double origin or of segmentally arranged ganglia, but from time to time it gives off a nerve which passes into the body wall and there splits into a right and left nerve; these reunite in the dorsal middle line and so form a nerve ring. These nerve rings are especially conspicuous in the skin of the introvert. The second pair of nerves given off from the brain pass into the base of the lophophore, and give off a branch into each tentacle, where it lies immediately beneath the ciliated groove. The third pair, which arise nearest the median line, pass to supply the skin of the pre-oral lobe.

The sense organs are of two kinds: (i) sensory pits in the brain, (ii) ectodermal sense organs in the introvert. The former are two pits which open on to the pre-oral lobe, and end blindly in an expanded vesicle in the substance of the brain. They are lined with columnar epithelium, which at the inner end is crowded with dark-brown pigment. Their lumen sometimes contains a clot. The latter are groups of ectodermal cells, which have increased in size and at their outer end are provided with short stiff processes which project above the general level. These are gathered together into a small brush by a chitinous ring which surrounds their base. These organs occur in rings at the base of the rings of hooks in the introvert.

*The Reproductive Organs.*—*Phymosoma varians* is dicecious. In both sexes the reproductive organs form fimbriated ridges which are attached to the bases of the ventral retractor muscles, and are continuous across the interspace between these two muscles, ventral to

the nerve cord. The cells forming these ridges are continuous with the peritoneal lining of the body wall, and in this region the elsewhere flattened epithelium has become modified to form the ova in the female and the mother-cells of the spermatozoa in the male. The ridge is thickened at its free end, and here the more mature generative cells are found. When ripe these dehisce into the body cavity in which they live for some time and increase in size. The ova found in the coelomic fluid are oval in outline, their nucleus is very large, and they are surrounded by a thick zona radiata. No ripe spermatozoa are found in the coelom, but their mother-cells exist in various stages of division.

*Conclusions.*—The more important contributions to the anatomy of the Gephyrea contained in the foregoing Abstract are the descriptions of (i) the head with the extensible collar, (ii) the skeletal structures, (iii) the minute anatomy of the nephridia, and (iv) the histology of the nervous system and sense organs.

The most important conclusions to be drawn from these facts seem, in my opinion, to confirm those systematic writers who assign *Phoronis* a position in the immediate neighbourhood of the unarmed Gephyrea. In addition to the points upon which they lay stress in the general anatomy of these forms, I would point to the close similarity in structure and position of the skeletal tissues in both groups, and the possible homology between the collar in *Phymosoma* and the extensible calyx which surrounds the head in *Phormis*.

VIII. "On the Dentition of *Ornithorhynchus*." By OLDFIELD THOMAS, Natural History Museum. Communicated by Dr. GÜNTHER, F.R.S. Received May 8, 1889.

[PLATE 2.]

At the meeting of the 9th of February, 1888,\* Mr. E. B. Poulton communicated to this Society the first discovery of the presence of teeth in *Ornithorhynchus*, a discovery which naturally awakened extreme interest throughout the scientific world. This first account was afterwards elaborated into a long and excellent description† of the form, structure, and development of the teeth, and their relationship to the horny plates (or "cornules," as they may be conveniently termed) which form the functional masticatory organs of the adult animal.

Apart from the valuable histological descriptions, the conclusions put forward in Mr. Poulton's paper may be briefly epitomised as follows:—

\* 'Roy. Soc. Proc.' vol. 43, 1888, p. 353.

† 'Quart. Journ. Microsc. Sci.' vol. 29, 1888, p. 9.